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Introduction

Cell Mechanisms and Cell Biology

In order to succeed in solving these various problems, one must so to speak progressively dismantle the organism, as one takes to pieces a machine in order to recognize and study all its works.

(Bernard, 1865, Part II, Chapter 1)

1. A DIFFERENT KIND OF SCIENCE

To many people, cell biology is an unlikely domain to impart impetus for a major shift in the way philosophy of science is practiced. Cells appear to be the object of straightforward empirical observation, not of bold theories that challenge the status quo. In high school or at the museum you look into the microscope and struggle to see what you are told you should see – structures that are never as sharp and well delineated as in the drawings in textbooks. What could cell biology be but a tedious descriptive science? This popular conception, however, is quite erroneous. Cells, as Theodor Schwann first concluded in the 1830s, are the basic units of life. They perform all essential vital functions: extracting energy and building materials from their environment, constructing and repairing themselves and synthesizing products for export, regulating their own internal operations, reproducing themselves periodically by dividing, cleaning up their own waste, and so forth. Beginning in the 1940s an initially small cadre of investigators who were pioneers in the modern discipline of cell biology began to figure out the biochemical mechanisms that enable cells to perform these functions. Although miniaturized, the mechanisms they found to be operative in each cell are staggeringly complex. Their work and that of their successors, primarily in 1940–70, revolutionized our understanding of the basic processes of life. Now, half a century later,